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Orii

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[54] **REVERSING APPARATUS**

[75] Inventor: **Masaru Orii**, Machida, Japan

[73] Assignee: **Kabushiki Kaisha Orii Judoki Seisakusho**, Japan

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Related U.S. Application Data

[63] Continuation of Ser. No. 292,215, Aug. 12, 1981, abandoned.

[30] **Foreign Application Priority Data**

May 15, 1981 [JP] Japan 56-72220

[51] **Int. Cl.**[3] **B65G 47/24**

[52] **U.S. Cl.** **414/759**; 414/774

[58] **Field of Search** 414/758, 759, 763, 774

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Primary Examiner—Leslie J. Paperner

Assistant Examiner—Ken Muncy

Attorney, Agent, or Firm—Kane, Dalsimer, Kane, Sullivan and Kurucz

[57] **ABSTRACT**

This disclosure pertains to an apparatus for turning a workpiece upside down. The apparatus is constructed of first and second arms supported on a base, the first arm comprising a lower section that is pivotably connected to the base, an upper section that can be pivoted from a horizontal position to a downwardly inclined position, and a central section that is elongated from the lower section to the upper section, a first workpiece supporter that is pivotably connected to the upper section of the first arm;

a first lever to pivotably actuate the first workpiece supporting; a second lever means to pivotably actuate the first arm;

the second arm comprising a lower section that is supported on the base, an upper section that can be pivoted from a horizontal position to a downwardly inclined position; a third lever to pivotably actuate a moving member mounted on the upper section of the second arm; and a second workpiece supporter positioned on the moving member; whereby the workpiece held on the upper section of the first workpiece supporter is transferred to the upper section of the second arm below the work plane while being turned upside down.

1 Claim, 8 Drawing Figures

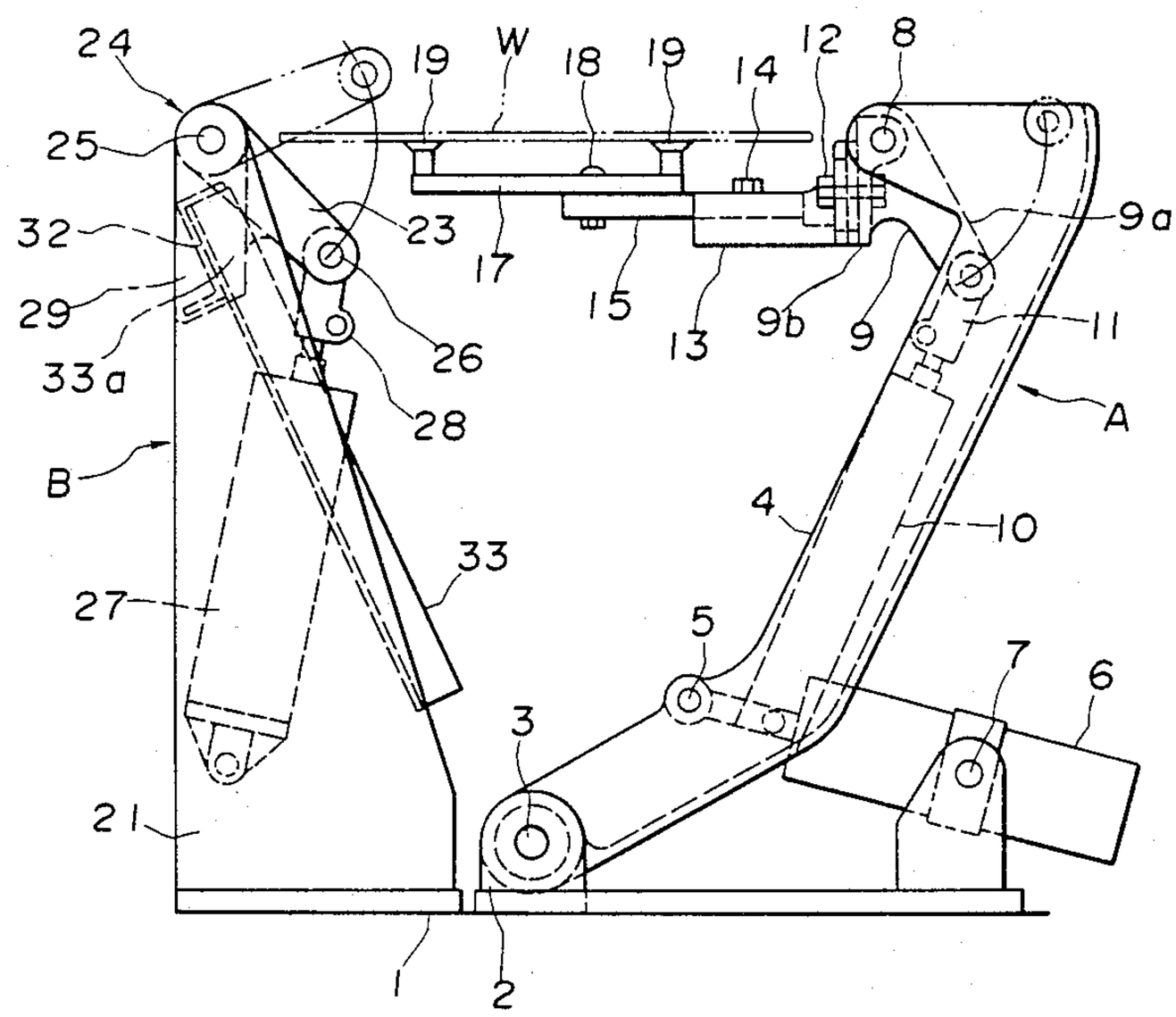
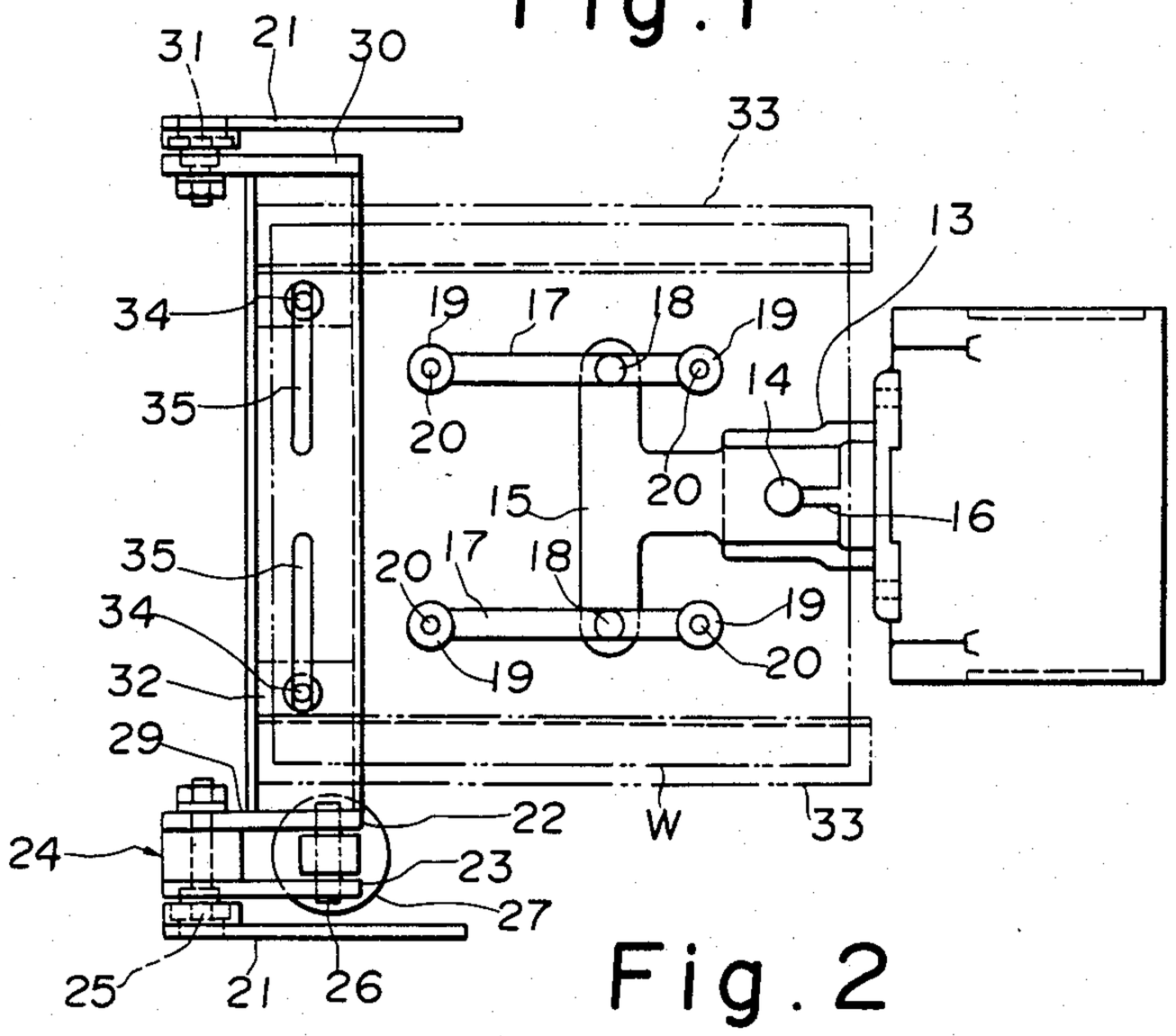


Fig. 1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W
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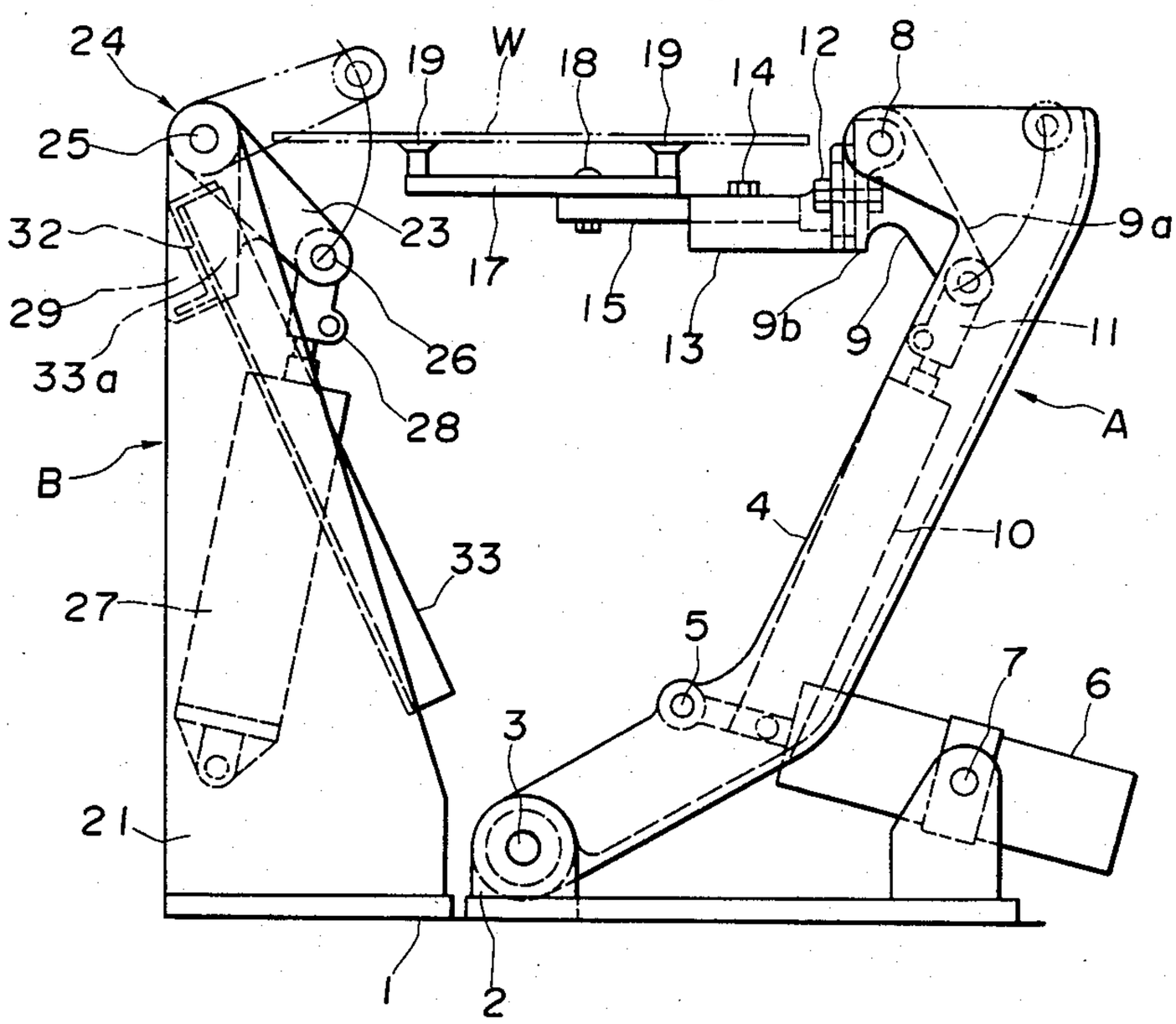
25
21
26

Fig. 2


24
19
W
18
19
14
12
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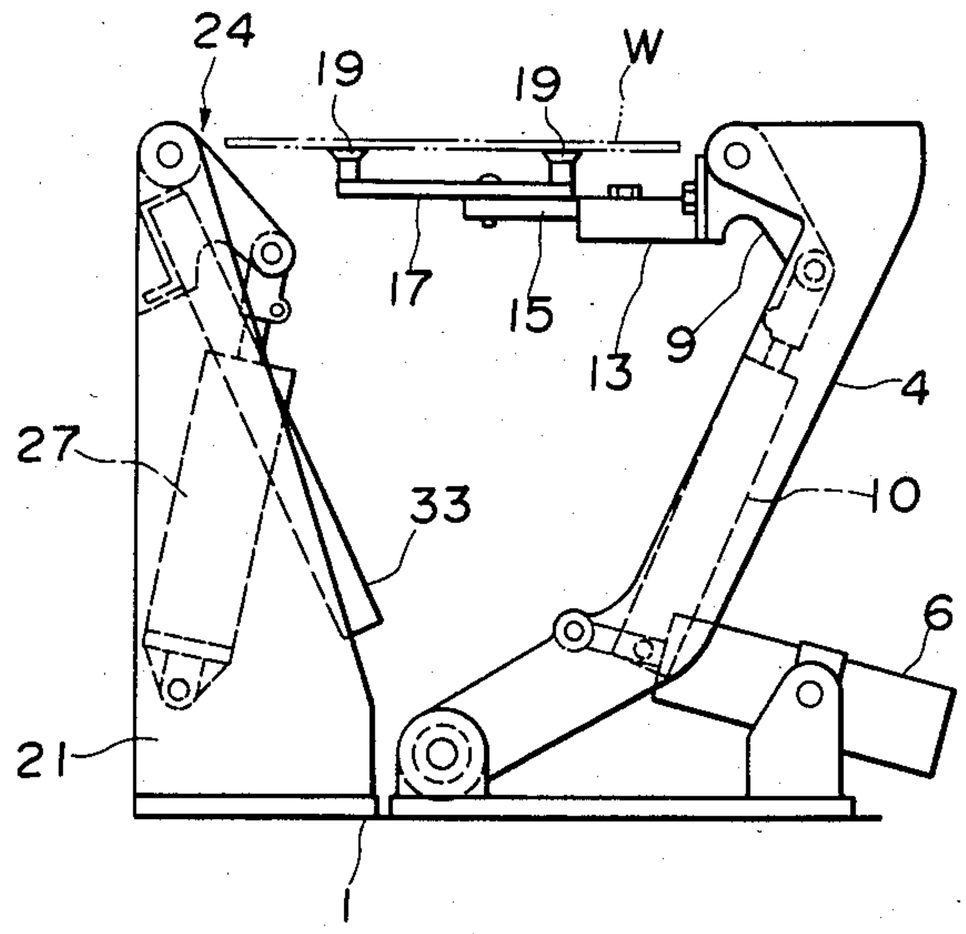
9a
32
23
17
15
13
9b
9
11
29
26
33a
28
A
B
4
10
33
27
5
7
6
3
21
1
2

Fig. 3


24
19
19
W
17
15
13
9
4
27
33
10
6
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1

Fig. 4

9
24
W
4
19
13
17
15
27
33
19
10
6
21
1

Fig.5

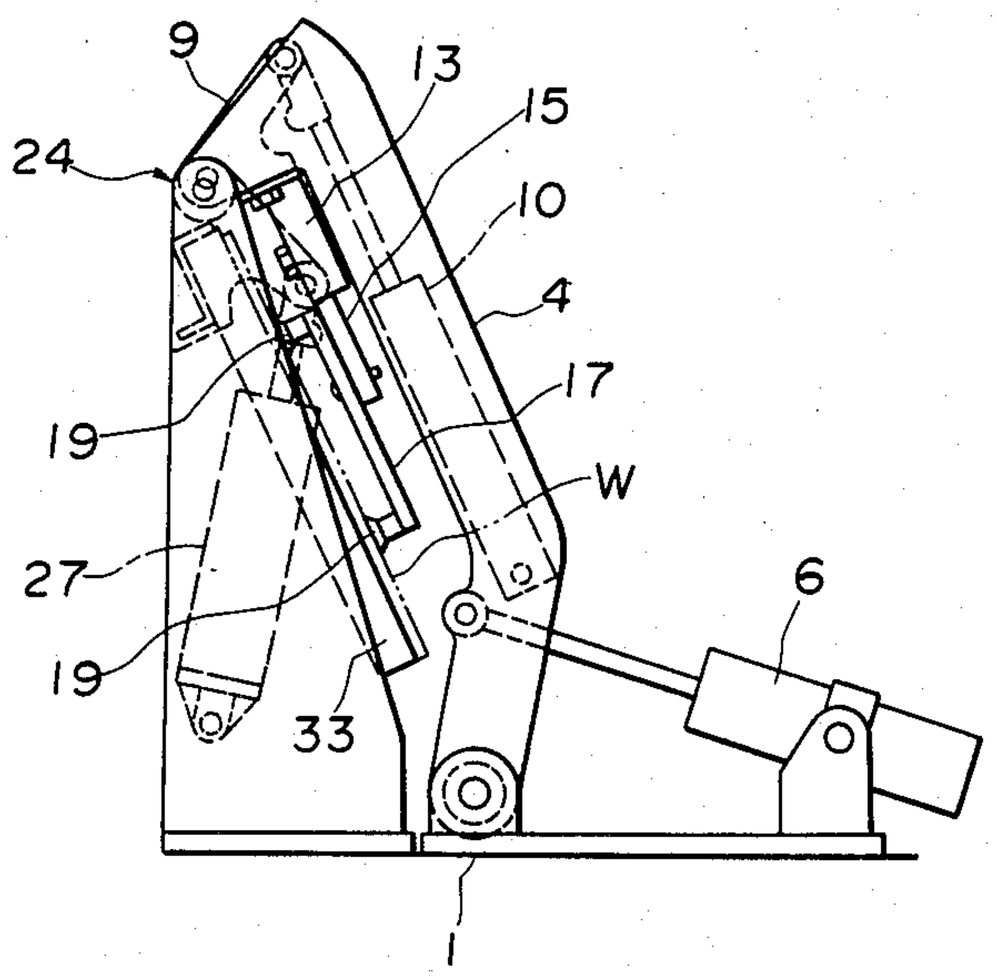
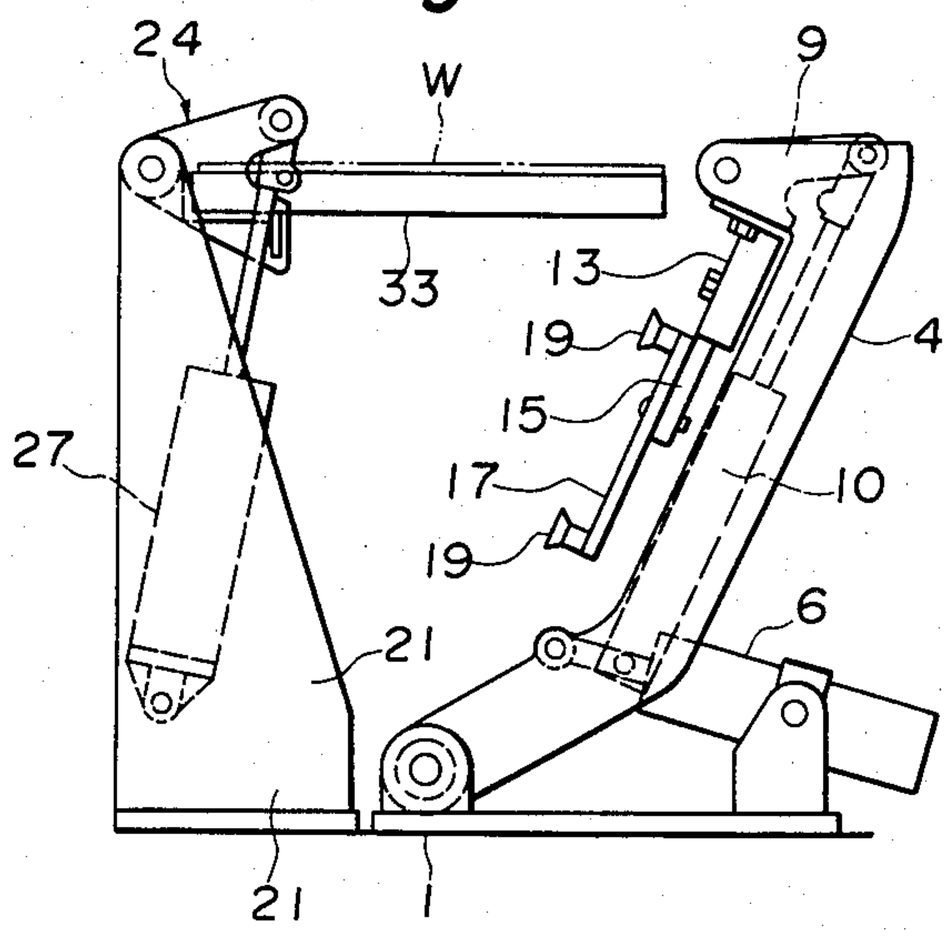


Fig.6

Fig. 7


24
W
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33
13
19
4
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27
17
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19
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Fig. 8

24
9
13
19
4
15
27
17
10
19
33
6
21
1

REVERSING APPARATUS

This is a continuation of application Ser. No. 292,215, filed Aug. 12, 1981, now abandoned.

FIELD OF THE INVENTION

This invention relates to an apparatus which is installed in the working line for turning the workpiece upside down.

BACKGROUND OF THE INVENTION

The conventional reversing apparatus uses a flat member which receives a workpiece in one horizonal position and is rotated about a horizontal axis by 180° to transfer the workpiece over the axis to the adjacent flat member in another horizontal position. When the workpiece grabbed by vacuum suction cups is rested on the receiving member in one horizontal position, it is rotated by 180° to another horizontal position and the reversed workpiece is transferred to the working line in said new horizontal position. According to this reversal system, the vacuum suction cups must be lifted high and retracted to be outside the area of rotation of the receiving member when it is making a 180° turn, so the period of retracting the cups is included within the period of reversing the workpiece. This means a prolonged and hence, inefficient reversing operation. Furthermore, raising the cups high requires the use of a tall reversing apparatus and a long and complex piping system connected to the cups.

SUMMARY OF THE INVENTION

Therefore, one object of this invention is to provide a reversing apparatus capable of reversing a workpiece in a short period of time.

Another object of this invention is to provide a reversing apparatus which does not require a large installation space and requires only a short and simple piping system for the vacuum suction cups.

PREFERRED EMBODIMENT OF THE INVENTION

One preferred embodiment of this invention is now described by reference to the accompanying drawings, wherein:

FIG. **1** is a plan view of a reversing apparatus according to this preferred embodiment;

FIG. **2** is a front view of FIG. **1**; and

FIGS. **3** to **8** schematically represent the sequence of the operation of the reversing apparatus of FIG. **1**.

In FIG. **1**, the base table of the reversing apparatus according to this invention is generally indicated by the numeral **1**. A pair of brackets **2**, **2** on the right-hand section of the base table are pivotally connected to clamping arms **4**, **4** by pins **3**, **3**. Each clamping arm, **4** is generally L-shaped and the end of the piston rod (that is, first lever) of a first hydraulic cylinder (that is, means to actuate said first lever) **6** (hereunder referred to as the first cylinder) is connected slightly down below the central part of the clamping arm **4** by a pin **5**. The first cylinder **6** is connected to the base table **1** by a pin **7**. A crank member **9** is pivotally connected to the top of each arm member **4** by a pin **8**, and the operating end **9***a* of the crank member is connected to the end of the piston rod (that is, a second lever) of a second hydraulic cylinder (that is, means to actuate the second lever) **10** (hereunder referred to as the second cylinder) by a

connecting member **11**. Each of the second cylinders **10** is connected below the center of the clamping arm **4** so that it is substantially aligned with the longitudinal direction of the central part of the clamping arm **4**. A vacuum holder fixing member **13** is fixed between the operating ends **9***b* of the crank members **9**, **9** by bolts **12**. A T-shape vacuum holder **15** is attached to the top of the fixing member **13** by a bolt **14**. The bolt **14** is screwed into the fixing member **13** through a long slot **16**, and by moving the bolt within the length of the slot **16**, the location of the vacuum holder **15** can be adjusted in the horizontal direction in FIG. **1**. A plurality of elongated cup supporting members (two such members are shown in FIG. **1**) are installed by bolts **18**, **18** on both ends of an elongated portion that forms the foremost end of the vacuum holder **15**. The bolts **18** are screwed into the vacuum holder **15** through long slots (not shown) formed in the cup supporting members **17** in their longitudinal direction, and by moving the bolts within the slots lengthwise, the location of the cup supporting members **17** can be adjusted in the horizontal direction in FIG. **1**. The cup supporting members **17** are pivotable about the bolts **18** and can be installed in a suitable pivoting position. A bowl-shaped cup **19** made of rubber, synthetic resin, etc. and having an open top is mounted on the top of both ends of each cup supporting member **17**, and these cups are positioned on the same plane as that formed by similar cups **19** mounted on the top of both ends of the other cup supporting member **17**. A workpiece supporting arm is constituted of fixing member **13**, bolt **14**, vacuum holder **15**, cup supporting member **17**, bolt **18** and bowl-shaped cup **19**. And the underside of hole **20** in the center of each cup **19** is connected by a pipe to a vacuum means (not shown). The underside of a hole **20** in the center of each cup **19** is connected by a pipe to a vacuum means (not shown). The above named components make up a first arm A on the right side of the base table **1** wherein the clamping arms **4** are positioned at the lower part and the cup supporting members **17** are positioned at the upper part of the system.

A pair of frames **21**, **21** are fixed upright to the left-hand section of the base table **1**. A U-shaped pivotally moving member **24** formed by integral combination of a pair of elements **22**, **23** is connected to the upper end of one of the frames **21** by a bolt **25**. A pin **26** is provided between the foremost ends of the elements **22**, **23**, and the pin **26** is connected to the end of the piston rod (that is, a third lever) of a third hydraulic cylinder (that is, means to actuate the third lever) **27** (hereunder referred to as the third cylinder) by a connecting member **28**. The third cylinder **27** is connected to the part of said one of the frames **21** which is somewhat down below its center so that the cylinder **27** is substantially in an up-right position. A supporting member **29** is fixed to the element **22**, and a similar supporting member **30** is pivotally connected to the other frame **21** by a bolt **31**. A guide member **32** whose cross section is similar to that of a crank is provided between the supporting members **29**, **30**, and two receiving members (that is, workpiece supporting arms) **33** having a slidable element **33***a* at one end are attached to the upper surface of the guide member **32** by bolts **34**. Each bolt **34** is attached to the slidable element **33***a* as it is guided by a long slot **35** in the guide member **32**, and by moving the bolt along the length of the slot **35**, the location of each receiving member **33** can be adjusted in the vertical direction in FIG. **1**. On the upper surface of each receiving member

33, there are projections (not shown) that engage predetermined portions, say, holes, in the surface of the workpiece W to be reversed. The above identified components make up a second arm B on the left side of the base table 1 wherein the fixed frames 21 are positioned at the lower part and the receiving members 33 are positioned at the upper part of the system.

The reversing apparatus of this invention having the above described arrangement is installed on the working line and is so positioned that the workpiece W to be reversed is rested on the cups 19 when the cup supporting members 17 are in a horizontal position as indicated in FIG. 2.

The sequence of operation of the reversing apparatus according to this invention is now described by reference to FIGS. 3 to 8. FIG. 3 shows the apparatus in a stand-by position. The piston rods of the cylinders 6, 10 and 27 are in a retracted position; the clamping arms 4 are in the farthest position of clockwise pivoting, the crank members 9 are in the farthest position of counterclockwise pivoting for bringing the cup supporting members 17 to a horizontal position; and the pivoting member 24 is in the farthest position of clockwise pivoting for making the receiving member 33 inclined downward. If the workpiece W to be reversed is rested on the cups 19 as shown by the one long and two short dashed line in FIG. 3, a vacuum means (not shown) sucks air to securely hold the underside of the workpiece W by the cups 19. Thereafter, the piston rod of the second cylinder 10 is extended as shown in FIG. 4, and the crank members 9 are pivoted to the farthest position of clockwise pivoting for making the cup supporting members 17 inclined downward. Throughout this pivoting motion, the workpiece W remains sucked to the cups 19. Subsequently, the first cylinder 6 is extended as shown in FIG. 5, the arms 4 are pivoted to the farthest end of counterclockwise pivoting to bring the obverse side of the workpiece W into face-to face relationship with the receiving members 33. Then, the projections (not shown) on the receiving members 33 come into engagement with the holes in the obverse side of the workpiece W. After the engagement is completed, the creation of vacuum to hold the workpiece W on the cups 19 is terminated. Then, as shown in FIG. 6, the piston rod of the first cylinder 1 is retracted and the arms 4 are pivoted clockwise to return to the farthest end of pivoting. Consequently, the workpiece W is transferred to the receiving members 33 and securely held by the projections on said members. In the next step, the piston rod of the third cylinder 27 is extended and the pivoting member 24 is pivoted clockwise to the farthest end of pivoting until the receiving members 33 become level. As a result, the workpiece W is now in the position where it was initially rested on the cups 19 but it has been turned upside down.

After the reversed workpiece W is sent to the subsequent working line, the piston rod of the third cylinder 27 is retracted again as shown in FIG. 8, so are the piston rods of the first and second cylinders 6 and 10, and, in consequence, the reversing apparatus of this invention is returned to a stand-by position as shown in FIG. 3. By repeating the above cycle automatically, the reversal of the workpiece W can be performed continuously. It is to be noted that the construction of the mechanism installed in the upper portion of the first and second arms A and B to hold the workpiece W in position, or that of the means to actuate the two arms is by no means limited to the illustrated embodiment, and various design alterations are possible depending upon the type of workpiece.

As described in the foregoing, the reversal apparatus according to this invention achieves smooth reversal of the workpiece by the cooperation of the first and second arms, so the workpiece can be turned upside down efficiently in a short period of time. Furthermore, the apparatus may be installed below the working line, so only a short piping system is necesssary for connection to vacuum means and a fairly small installation space is required for the apparatus.

What is claimed is:

1. A reversing apparatus for turning a workpiece upside down including:

a. a base;

b. a first arm comprising:

1. a pair of L-shaped members each having a lower end pivotably connected to said base, and an upper end;

2. a first cylinder attached to said base, with a piston rod, an end of the piston rod being pivotably connected to said lower ends of said pair of L-shaped members and capable of pivoting said first arm from a first to a second position with respect to said base;

3. a pair of crank members being pivotably connected by connecting means to the upper ends of said pair of L-shaped members each having an operating end extending past said connecting means;

4. a second cylinder being connected to the lower ends of said pair of L-shaped members, and being coextensive with the upper ends of the pair of L-shaped members, and having a piston rod with a piston rod end being pivotably connected to said operating ends of said pair of crank members, said second cylinder being provided to pivot said crank members from a horizontal to an inclined position; and

5. a workpiece supporting member attached to said crank members and comprising:

A. a holding member attached to said crank members;

B. a T-shaped member attached to said holding member with two lateral extensions;

C. a plurality of vacuum support members attached to said lateral extensions; and

D. a plurality of bowl-shaped cups attached to said vacuum support members and adapted to hold a work piece when vacuum is applied to said cups; and

c. a second arm comprising:

(1) a first and second frame fixed upright to said base adjacent to said first arm, each having a lower frame end and an upper frame end;

(2) a pivoting member connected to the upper frame end of said first frame;

(3) a work-piece support member extending between said frames and being affixed to said pivoting member at one side and being pivotably affixed at another side to the second frame; and

(4) a third cylinder being connected to the lower frame end and having a piston rod with an end connected to said pivoting member and provided to pivot said work-piece support member between an inclined and a horizontal position;

said first arm being constructed and arranged to move a workpiece disposed on said workpiece supporting member from a horizontal position to an intermediate

position by pivoting said crank members to said inclined position and then pivoting said first arm from said first to said second position, said workpiece in said intermediate position being oriented passed its vertical dead center; and

said second arm being constructed and arranged to receive said workpiece from said first arm when said first arm is in said intermediate position.

* * * * *